Memorandum

To: Trinda L. Bedrossian
Supervising Geologist

Date; April 8, 1998

From: John Schlosser, Associate Engineering Geologist
Department of Conservation -- Division of Mines and Geology

Subject: Initial Report for Mission Peak Slide City of Fremont, Alameda County, California

On March 31, 1998, David Howell of the U. S. Geological Survey (USGS) informed the Department of Conservation's Division of Mines and Geology (DMG) about a meeting requested by the City of Fremont, regarding a large landslide that had recently occurred near Mission Peak in the hilly eastern part of the City. The purpose of the meeting was to enable City officials to gather information and advice from geologists on how best to proceed with 1) assessing the potential for the slide to cause injury or property damage, and 2) what, if anything, could be done to mitigate the effects of the landslide. The landslide is estimated to be 120 acres in size, located in the upper part of the Canada del Aliso Creek watershed (Sections 5,6,7, and 8, T5S/ R1E, MDBM, Niles 7.5' Quadrangle). The meeting was held on April 1 at the Fremont City office.

Participants at the City of Fremont meeting April 1, 1998.

Participants	Affiliation	Phone Number
Richard Asimus, P.E. City Engineer	City of Fremont	(510) 494-4680
Allen Shelly, P.E. Assistant City Engineer	City of Fremont	(510) 494-4682
Sandra Fox Special Counsel	City of Fremont	(510) 494-4716
J. David Rogers, CEG	Geolith Consultants	(510) 682-7601
William Cotton, CEG	Cotton, Shires & Assoc., Inc.	(408) 354-5542
David Howell Research Geologist	USGS	(650) 329-5430
John Schlosser, CEG	DMG	(916) 445-2673

Other City of Fremont officials were present at various times during the meeting.

Subsequently on April 7, 1997 Richard Eisner, from the Governor's Office of Emergency Services (OES), requested DMG's participation under OES Mission #98-CST7267.

Geologic Concerns:

The slide is a composite of many parts, displaying different types of movement, including rockfall, translational, rotational, earthflow, and debris flow. There is one house adjacent to the toe, and the toe bulge has pushed the ground upward some 30

feet in very close proximity to the house. However, at the time of the meeting, the house was still outside the perimeter of the active landslide, and unaffected by any ground deformation. The slide has moved downslope an estimated 150 feet in the upper portion, but only a few feet in the toe area, so far. The concern is that movement could accelerate in the toe area, or that the generally slow movement in the toe area could go on for months, in which case several other houses directly downslope could be threatened. Houses in the area are quite large and expensive.

Discussions at the Meeting

Asimus opened the meeting by explaining why the City of Fremont had called the meeting, and by setting an agenda of items to be covered. The meeting was called in response to a very large landslide that had begun to move sometime the previous week (week of March 22-28). Rogers had been hired by the City to investigate what could be done about the slide in order to avoid or minimize property damage or personal injury to city residents. Asimus wanted to “pick the brains” of the assembled geologists and engineers at the meeting for any related information about the nature of the slide and what should be done; what each agency or consulting company could do to help in the investigation of this slide or related hazards; and what might be the possible sources of funding to help the City pay for investigation and mitigation of this slide or related hazards. Of primary concern to the City was the present landslide, which is known as the “Mission Peak” landslide. However, as was pointed out during the ensuing discussion, there are other dormant landslides in, or near, the City which are similar in nature to the one which has recently reactivated, and the City should consider additional investigation in the near future to identify these other hazard areas. Each of the geologists present had an opportunity to present information that was relevant to the investigation of the Mission Peak slide, as well as make comments about other slide hazards potentially affecting the City, and offer any information about possible sources of funding or “help” that each agency or company could provide for these tasks. Rogers had flown over the slide, taken dozens of photos, and had walked much of the slide on the ground. He had also prepared a work proposal for what should be done to: (1) investigate the nature of the slide (which appeared very complex) and to monitor the movement of various parts of the slide; (2) determine what could be done to stop, or at least minimize, the impact of the movement of the slide, and (3) determine what should be the long term management of the slide. Much of the meeting revolved around his description of slide conditions, and his proposal for what should be done. Cotton had also walked over much of the slide and offered his observations of conditions, and what should be done. The landslide conditions described in the meeting are described below in “Geologic Conditions”.

Cotton confirmed many of the landslide observations that Rogers had made, and added others resulting from his ground reconnaissance on March 29th.

Howell pointed out that landslide mapping done by the USGS showed that many of the slopes on the hills to the east of the City were covered with old landslides, and that the reactivation of this large landslide by the prolonged wet weather could well be a forewarning that other similar large old slides could resume movement in the near

future. Detailed mapping showing the locations of these potential sites of renewed landslide movement would be valuable to the City, in terms of zoning and minimizing property and personal injury losses in the future. Such detailed mapping would be in the category of future work that should be done, and would not add much to solving the current landslide problem. However, the USGS and DMG have the expertise to undertake such a program of landslide hazard mapping.

Rogers also noted that there is a very real risk of a large volume of rock fall from the headscarp area of the current slide, as well as other areas, in the event of an earthquake in the south Bay Area. He pointed out that DMG is currently doing seismic landslide hazard mapping in southern California, and the City should consider having similar work done, if funding becomes available.

Schlosser of DMG reiterated that the agency has the capability to do mapping of individual landslides at large scale, regional landslide hazard mapping as we did in our past landslide mapping program, or on a regional scale (or just within the City of Fremont) for seismically induced landslide hazard evaluation, as we are currently doing in southern California.

The consensus at the conclusion of the meeting was that Rogers should proceed with the first part of his work proposal, to obtain enough information to characterize the slide and its movement. During the following day or two, survey monuments would be located and installed on and around the slide. A ground survey would be done by a local survey company, under supervision of Rogers. The USGS would take low-level, large scale aerial photography of the slide as soon as the survey monuments were in place (by the 4th of April if at all possible). Then 10 days after the USGS aerial flight, a detailed topographic map would be produced for use in ground mapping of the slide. The ground mapping would be carried out principally by Rogers's consulting company, with assistance from Cotton (on a pro-bono basis). Any other personnel that could do slide mapping, from either the USGS or DMG, would be welcome, and should check in with Rogers who will be coordinating the mapping. Because of the sensitivity of neighbors, who may be impacted by the landslide, the City did not want geologists just showing up and walking up onto the slide. They preferred that Rogers coordinate mapping and monitoring activities on the slide. Anyone wishing to go on the slide should check in first with Rogers for instructions about access through gates, etc. Rogers estimated that ground mapping would begin about April 14th, or soon after, and last for a week to 10 days.

Geologic Conditions:

The landslide is located on the southwest facing flank of a prominent ridgeline east of the City of Fremont known as Mission Peak. The headscarp is located near the ridgetop approximately 2 miles east of the I-680/ Durham Road interchange. The slide is approximately 4000 feet long, 1000 feet wide, and is estimated to be several hundred feet deep in the center, and 40 to 70 feet deep in the toe area. USGS landslide mapping, which Howell showed at the meeting, shows dormant landslides covering most of the southwest flank of Mission Peak ridge. Specifically, the current slide is shown to be a reactivation of the southeastern 1/3 of a larger landslide feature. The

photos that Rogers took, as well as the topography on the Niles 7.5 minute topographic map, clearly show a large, very gently-sloping “unit surface” located at the base of a very steep 400 foot high headscarp of the old landslide. The body of the slide below the headscarp is moderately to gently sloping, hummocky ground. The slide appears to have several component parts moving at different rates, with different styles of motion.

The steep headscarp of the currently active slide moved primarily as a rock fall. The material exposed in the headscarp is mostly graben infill, and slough from the old headscarp, not fresh rock. Various component parts within the body of the slide have moved as rotational slides, translational slides, block glides, earthflows, and debris flows. Movement in the upper portion of the slide has amounted to about 150 feet laterally and, in the toe area only 10-15 feet. There is a distinct toe to the upper portion, that has formed approximately half way down the slide. It appears that the movement of the upper portion has pushed and loaded the lower part of the slide, so that the lower part has shifted in response. The lower portion has moved less, shows less internal deformation, but has produced a dramatic toe bulge, moving a narrow zone upward approximately 40 feet in the past week. There may be a resistant ledge of sandstone present near the toe of the present slide that is forcing the plastic clay of the landslide mass to bulge upward, rather than move downslope.

In front of the toe, the ground has begun to bulge upward in a broad, dome-shaped bump a few hundred feet downslope of the present toe. The bump is related to the slide movement upslope, but it is not known exactly how, so it is hard to predict at this time how much deformation there will be, and whether the bump will expand in size.

Mission Peak ridge is underlain by upper Miocene marine sediments of the San Pablo group described as sandstone, conglomerate, and claystone (Rogers, 1966). Much of the steep headscarp area of the old, large slide is underlain by bedrock. Rogers described a tension crack that is about 100 feet long and 3 to 4 feet wide, that is located several hundred feet upslope from the present scarp. He viewed the scarp with Clyde Wahrhaftig about 20 years ago, who said he thought the crack probably opened up in the 1906 earthquake, but had remained essentially unchanged since then. Rogers observed the crack to open up another 6 inches in this past week. The tension crack is defining a large wedge of bedrock, which will eventually calf-off the old headscarp, and tumble down slope onto the landslide mass. He estimated the block that would calf-off to be about 100,000 cubic yards. He is not sure what the result would be in terms of how far the blocks of rock would actually travel downslope. But it does represent a hazard, especially if the slope were subjected to strong earthquake shaking. The added weight placed on the head of the slide would likely start the slide mass moving faster again. The tension crack is visible in the photos that Rogers took of the headscarp area.

<u>Recommendations:</u>

It would be helpful to the City of Fremont to assist Rogers in ground mapping the landslide, in order to expedite the characterization of the landslide, so that feasible mitigation measures can be initiated as soon as possible. It would also provide an

opportunity for DMG to be involved in studying a spectacular geologic phenomenon, which has gotten a lot of media attention in the Bay Area. Cotton said this is the biggest active Bay Area slide he has ever seen.

The possibility of doing landslide hazard mapping, or seismic landslide hazard mapping within the City of Fremont, or possibly for the topographic quadrangles that contain the City, should be explored. I believe the City would be benefited by knowing where these hazardous areas are, and we have the expertise and equipment necessary to define these hazard areas accurately.

References:

Rogers, Thomas H., 1966, Geologic Map of California, San Jose Sheet; California Division of Mines and Geology, scale: 1:250,000.

John P. Schlosser
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Attachment Location Map

cc: Jim Davis
Chuck Real
Richard Eisner

Location Map of the Mission Peak Landslide – Fremont, California

Shown on base map of 1961 topographic map of the Niles 7½ minute